DON'T PANIC AND LOOK UP!

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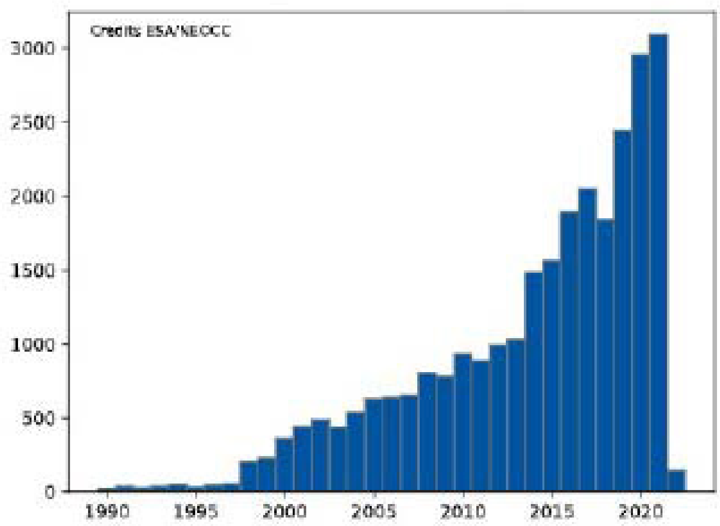
Many of you will surely have watched Don't Look Up over your winter break. Those of you that work on NEO impact monitoring and are used to choosing every single word carefully when talking to the media, to making sure you are not accused of fostering panic, might actually have been relieved when you watched this film. Here everyone is desperately and deliberately trying to panic journalists, politicians, security officers and the citizens, with little if no success at all (at least at first).

Of course, it is clear from the very beginning that Don't Look Up is not another blockbuster on cosmic impacts: the threat posed by a newly discovered comet is the perfect choice for addressing more earthly hazards (e.g. global warming) of which initially only a restricted group of experts are aware. However, discussing the many technical details used in the film to explain how astronomers discover an NEO on a collision course with our planet and the actions undertaken to face the threat, turns out to be an interesting exercise. It allows us to show, by sheer comparison with reality, advances in terms of technical developments and international coordination achieved in the last 10 years, as well as the potential contribution of NEOROCKS.

Firstly, it is rather unlikely that the discovery of a large active comet would occur as a serendipitous event. Since the beginning of this century, the efficiency of the network of telescopes that survey the skies every night searching for NEOs has been steadily growing. In 2021, the record-breaking figure of 3000 new objects per year was hit. That means three time more than the total number of objects discovered in the whole century since 1898, when the first Near-Earth asteroid (433 Eros) was spotted in the sky.



Discovered NEOs by years from 1st January 1990 to present

Moreover, impact monitoring is no longer performed by scientists writing formulas on a whiteboard, but by sophisticated software robots running at NASA-JPL, in California, and at the ESA NEO Coordination Center at ESRIN (Frascati, Italy). It is worth mentioning that the very first impact monitoring system, NEODyS, developed at the University of Pisa, went into operation in 1999 and is actively participating in the NEOROCKS project, providing inputs to our observers.

Then, there is the question of how to act once a threat is confirmed. The solution presented in the movie (give a call to the US President!) reflects the panel discussion closing the first Planetary Defense Conference organised in Granada (Spain) in 2009. At that time, the scientific community involved in NEO studies realised that there was no established procedure in place to interface with governmental institutions. This is a particularly dangerous missing link, considering the global nature of the threat. Since then, many official steps have been taken. Early attempts, represented by the UN Action Team 14 and by establishing the Spaceguard Foundation, have evolved into the IAWN (International Asteroid Warning Network) and SMPAG (Space Mission Planning Advisory Group) committees. Both of them, under the auspices of the United Nation Office for Outer Space Affairs (UNOOSA), gather a large community of professional and amateur astronomers, as well as aerospace engineers, who meet regularly to study impact scenarios and prepare mitigation actions.

In this context, NEOROCKS's goal of improving our knowledge of the physical characterization of the known NEO population, through performing dedicated observations and advanced data processing and dissemination, is essential to carry out realistic simulations.

TNG (the Italian Telescopio Nazionale Galileo) in La Palma (Canary Islands, Spain) is part of NEOROCKS' network of collaborating telescopes, allowing visible and near-infrared spectroscopic and photometric observations.

The [ASI Space Science Data Center (SSDC)]() takes care of the NEOROCKS data dissemination; it already hosts an impressing collection of astronomical data and guarantees their availability to the scientific community.

The outcome of an impact in fact depends strongly not only on the trajectory and the size of the impacting body, but equally on its chemical composition and internal structure. This is particularly true, rather than the extremely improbable event of an impacting 10-km Oort cloud comet as in Don’t Look Up, for the much more frequent “imminent impactors”. These are tiny (10-m class) bodies on a collision trajectory, discovered with short warning times.

We know that a rocky, loosely-bound NEO of that size almost completely burns up upon entering the atmosphere. On the other hand, if it is of iron composition, it is capable of reaching the ground and forming an impact crater. Should such a threat materialise, a key issue for planetary defense is to react in a matter of hours, or days at the latest, coordinating observations aimed at both astrometry and physical characterisation. The former is needed to shrink the so-called “impact corridor” down to a precise location on the surface of the Earth, the latter to estimate ground damage reliably. Only upon receiving these basic inputs, can civil protection authorities determine the level of alert and put into place the necessary mitigation actions. With this is mind, it becomes clear why NEOROCKS focuses on characterising small, recently discovered NEOs. But the Neorockers have decided to move even farther. Presently, the observational and data-analysis effort described above is performed on a voluntary basis and with a high level of human intervention. Why not profit from the expertise in our project to check how far we can go in automatising this process? This can be considered the very first step toward a fully operational, rapid response system. Just in case of panic....